

Biological observations on *Anthophora urbana urbana* Cresson

(Hymenoptera: Anthophoridae)¹

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The genus *Anthophora* is distributed throughout the world, except Australia, with an estimated 60 species in America north of Mexico (Stephen *et al.*, 1969). *Anthophora urbana urbana* Cresson is reported from Washington, Idaho, Colorado, Utah, New Mexico, Arizona, California, and Lower California (Michener, *in* Muesebeck *et al.*, 1951). Biology of certain species of *Anthophora* other than *u. urbana* has been partially described (Linsley, 1958; Linsley and MacSwain, 1942). Observations on *A. u. urbana*, a gregarious, ground-nesting, solitary bee have been limited to scattered notations (Stephen *et al.*, 1969). This paper describes some aspects of its biology in Washington.

NESTING SITE

A. u. urbana was found nesting near Touchet, Walla Walla County, Washington, in 1974. The surrounding area is composed of alfalfa seed fields and sagebrush desert, including such plants as sagebrush (*Artemisia*), rabbitbrush (*Chrysothammus*), Balsamroot (*Balsamorhiza*), and starthistle (*Centaurea*).

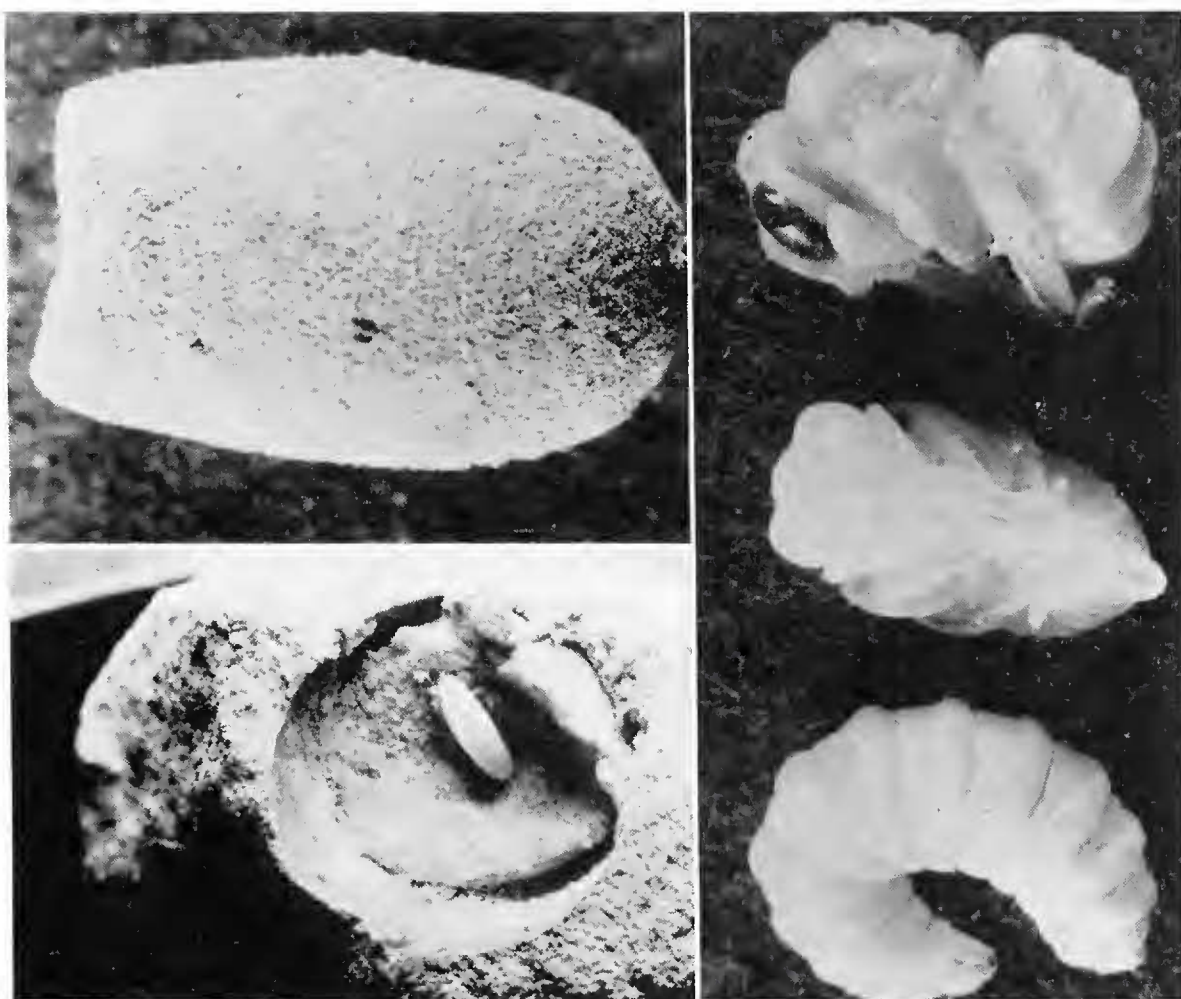
NEST CONSTRUCTION

Active burrows were found in dry, packed, sandy soil on a horizontal ground surface essentially free of vegetation, and on a nearby vertical bank of a railroad cut. Both horizontal and vertical nesting has been previously recorded for *A. u. urbana* and other species of *Anthophora* (Stephen *et al.*, 1969).

The circular (average $\frac{1}{2}$ inch diameter) entrance holes varied from 0–6 per square foot with the tunnels occurring at a 45 degree angle to the surface. Our observations agree with those of Linsley *et al.* (1952) that this species does not construct surface turrets or tumuli.

Within the burrows, several cells were found at the 3-inch level, none below 7 inches, with most occurring at 4 to 7 inches. Each cell appears urn-shaped (Fig. 1), and measures an average length of $\frac{5}{8}$ inch and $\frac{5}{16}$ inch at the widest point. Cell walls are lined with a white,

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FIGS. 1-3. *Anthophora urbana urbana*. Fig. 1. Completed cell (upper left). Fig. 2. Egg on pollen-nectar mixture in cell (lower left). Fig. 3. From bottom to top, prepupa, early pupa, late pupa (right).

waxy material. Earthen walls of the cell are much stronger than the surrounding soil, retaining their shape when they are removed from the ground which is typical of *Anthophora* (Stephen *et al.*, 1969).

Each cell is plugged with a soil cap $\frac{1}{32}$ inch thick which appears nearly flat from the outside. Inside the cell cap is concave with a slight impression near the center. Cells are arranged in a linear series with 4 cells the longest series found.

ADULT ACTIVITY

Adults were first observed at the nest site 10 July 1974. Since good numbers of both sexes were seen, emergence had undoubtedly started somewhat earlier. Observations were conducted weekly from 10 July to 7 September. Two distinct adult flight peaks were evident. The first flight was from 10 July to 23 July and the second was from 7 August to 21 August. There are 2 generations per year in the Touchet area of Washington with a sex ratio of approximately 1:1. Most North Amer-

ican *Anthophora* have one generation per season, but other bivoltine species have been recorded (Stephen *et al.*, 1969). A few adults were first observed at the nest site 23 June 1975. On 30 June 1975 the number of emergence holes ranged from 0–3 per square foot and by 8 July emergence holes ranged from 0–7 per square foot. Adults did not re-nest at this site during 1975.

Males emerged earlier than females and were observed at the nest site a maximum of 7 days earlier than females. Males milled around, on and above the nesting site and nearby vegetation and were observed taking nectar from alfalfa flowers. They pounced on both male and female bees on the nest site and were often seen looking into entrance and emergence holes and under dirt clods apparently in search of females.

Stephen *et al.* (1969) stated that multiple mating occurs from 10 to 15 minutes after female emergence, but the female is never approached after that time. They did not say where mating occurs. We observed a number of matings, all of which occurred at the nest site with newly-emerged females. We were unable to determine if multiple matings of females occurred. Males pounced on females on the nest site and immediately initiated copulation. Females remained passive. During copulation males assumed the dorsal position with forelegs wrapped around and above the female wings, middle legs about the center of the female abdomen, and hind legs used to stroke the sides of the female abdomen. Males apparently produce a vibrating noise with their wings which accompanies each pulsation of their abdomens. Mating lasted from 55 to 90 seconds. After copulation males immediately flew away, while females remained on the ground grooming themselves.

Linsley (1962) observed the unusual situation of female and male *A. u. urbana* sleeping gregariously together in the open in Arizona. We observed males sleeping gregariously on tumbled mustard (*Sisymbrium*), but no females were found in the aggregations.

A. u. urbana is a highly polylectic species. It has been reported collecting pollen from evening primrose (*Oenothera*) in the Great Basin (Linsley *et al.*, 1963), from onion (*Allium*) in Utah (Bohart *et al.*, 1970), and from creosote bush (*Larrea*) in Arizona and California (Hurd and Linsley, 1975). In California it collects pollen from alfalfa (*Medicago*) only when plants with more readily-available pollen are absent or through blooming (Linsley, 1946). This bee was observed tripping alfalfa flowers in Oregon (Tysdal, 1940). In Washington we found it collecting pollen from starthistle (*Centaurea*),

Table 1. Proportion of different stages of *A. u. urbana* found in samples taken at the nest site in 1974 and 1975.

	Eggs	Larvae	Prepupae	Light pupae	Pupae with dark eyes	Dark pupae	Teneral adults	Adults	Dead adults
23 July (1974)	2	8	40	18	32	—	—	—	—
30 July	—	—	14	—	14	21	15	36	—
14 August	12	—	37	—	—	—	—	51	—
28 August	—	—	80	—	—	—	—	20	—
14 March (1975)	—	—	88	—	—	—	—	—	12
10 June	—	—	—	—	—	—	100	—	—

tumblemustard (*Sisymbrium*), and sunflower (*Helianthus*). We observed females taking nectar from alfalfa (*Medicago*) before the wild hosts bloomed.

DEVELOPMENT

The proportion of different life stages of *A. u. urbana* found in 1974 and 1975 are given in Table 1. Unemerged adults were present in cells as late as 28 August, 1974, though this species is unable to overwinter as adults.

The pollen-nectar mixture is not shaped but packed tightly into the lower half of the cell and is neither dry nor moist but gruel-like in consistency. A single white, sausage-shaped egg is laid centrally on top of the pollen mass (Fig. 2). Each emerging larva consumes all of its provisions, then defecates. The feces are a viscous fluid deposited in the lower quarter of the cell.

Prepupae were collected and reared in chambers under different temperature ranges with 100% relative humidity. At 65 degrees F the prepupal stage lasted 26 days (range 21–40) and the pupal stage 42 days (range 35–46). At 75 degrees F the prepupal stage lasted 18 days (range 9–29) and the pupal stage 27 days (range 22–33). At 80 degrees F the prepupal stage lasted 16 days (range 15–23) and the pupal stage 11 days (range 8–12) (Fig. 3). The average temperature at 6 inches below the soil surface during the time of season involved is 79 degrees F in the Touchet area.

Adults which emerged in the laboratory were not fed and died after 5–6 days.

PARASITES, PREDATORS, AND OTHER NEST ASSOCIATES

The cleptoparasite *Xeromelecta* (*Melectomorpha*) *californica* Cresson was found in less than 1% of *A. u. urbana* cells, but was observed entering entrance holes. It appeared to be closely synchronized with its host as adults were most abundant at the nest site during the peak flight periods of the host. This cuckoo bee only attacks species of *Anthophora* (Hurd and Linsley, 1951) and has been previously reported from *A. u. urbana* by Linsley (1939).

Larvae of *Trogoderma inclusum* Lec. destroyed the contents of a number of *A. u. urbana* cells in the vertical bank. This is a first record of *T. inclusum* from *Anthophora*. *T. ajax* Csy. has been found destroying *A. linsleyi* cells, though it is primarily a scavenger (Linsley and MacSwain, 1942) and *T. sternale* Jayne occurs in the nests of *Anthophora* (Linsley, 1944).

The coarctate larval stage of *Meloe niger* Kirby was found in the *A. u. urbana* nest site. This is a new host record for the black blister beetle. High numbers have been found attacking alkali bees, *Nomia melanderi* Ckll., in the Touchet area in recent years (Mayer *et al.*, 1975).

Adult *A. u. urbana* were sometimes parasitized by a conopid fly, probably *Zodion obliquefasciatum* (Macq.). This is the prevalent species which attacks alkali bee females in the area.

We also noted the occurrence of fungi infesting the pollen stores inside the cells, a Eurotiaceae and *Aspergillus flavus* Link.

Galleries of *A. u. urbana* in the vertical bank were readily utilized by the introduced alfalfa leafcutting bee, *Megachile (rotundata) pacifica* Panzer.

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